

Having thus defined the invention, the following is claimed:

1. A power supply connectable to a source of AC line voltage for AC electric arc welding by an AC arc current across a gap between an electrode and a workpiece, said power supply comprising a high capacity transformer to convert said line voltage to an AC output voltage, a rectifier for converting said AC output voltage to a DC voltage between a positive terminal and a common terminal at generally zero voltage and a negative terminal and said common terminal, a first switch for connecting said positive terminal to said common terminal across said gap when a given logic is applied to said first switch, a second switch for connecting said negative terminal to said common terminal across said gap when a given logic is applied to said second switch, a pulse width modulator having an input and an output from which is directed an output signal in the form of pulses created at a frequency of at least 18 kHz, said pulses of said output signal each having a width controlled by said input of said pulse width modulator, a controller for creating alternately a first switch gate signal for a first time and a second switch gate signal for a second time, first means for operating said first switch by said output signal during said first time, second means for operating said second switch by said output signal during said second time whereby said AC current has a positive portion during said first time and a negative portion during said second time.

2. A power supply as defined in claim 1 wherein said controller includes an output terminal at which is created a switch enable signal having a first logic during said first time and a second logic during said second time, means for creating said first switch gate signal when said switch enable signal is at said first logic and means for creating said second switch gate signal when

5 said switch enable signal is at said second logic.

3. A power supply as defined in claim 2 wherein said first means is a logic gate to apply said given logic to said first switch upon receipt of said output signal and said first gate signal.

4. A power supply as defined in claim 3 wherein said second means is a logic gate to apply said given logic to said second switch upon receipt of said output signal and said second gate signal.

5. A power supply as defined in claim 4 including a bidirectional, but selectable free wheeling circuit in parallel with said gap.

6. A power supply as defined in claim 5 wherein said bidirectional free wheeling circuit includes a series branch with a first bypass switch in parallel with a diode and poled from said workpiece to said electrode and a second bypass switch in parallel with said diode and poled from said electrode to said workpiece, said first and second bypass switches being connected in series,  
5 means for closing one of said bypass switches during one of said times and the other of said bypass switches during the other of said times.

7. A power supply as defined in claim 3 including a bidirectional, but selectable free wheeling circuit in parallel with said gap.

8. A power supply as defined in claim 7 wherein said bidirectional free wheeling circuit includes a series branch with a first bypass switch in parallel with a diode and poled from said workpiece to said electrode and a second bypass switch in parallel with said diode and poled from said electrode to said workpiece, said first and second bypass switches being connected in series, means for closing one of said bypass switches during one of said times and the other of said bypass switches during the other of said times.

9. A power supply as defined in claim 2 including a bidirectional, but selectable free wheeling circuit in parallel with said gap.

10. A power supply as defined in claim 9 wherein said bidirectional free wheeling circuit includes a series branch with a first bypass switch in parallel with a diode and poled from said workpiece to said electrode and a second bypass switch in parallel with said diode and poled from said electrode to said workpiece, said first and second bypass switches being connected in series, means for closing one of said bypass switches during one of said times and the other of said bypass switches during the other of said times.

11. A power supply as defined in claim 1 including a bidirectional, but selectable free wheeling circuit in parallel with said gap.

12. A power supply as defined in claim 11 wherein said bidirectional free wheeling circuit includes a series branch with a first bypass switch in parallel with a diode and poled from said workpiece to said electrode and a second bypass switch in parallel with said diode and poled from said electrode to said workpiece, said first and second bypass switches being connected in series,  
5 means for closing one of said bypass switches during one of said times and the other of said bypass switches during the other of said times.

13. A power supply as defined in claim 5 wherein said bidirectional free wheeling circuit includes a parallel branch with a first bypass switch in series with a diode and poled from said workpiece to said electrode and a second bypass switch in series with a diode and poled from said electrode to said workpiece, said first and second bypass switches being connected in parallel, means  
5 for closing one of said bypass switches during one of said times and the other of said bypass switches during the other of said times.

14. A power supply as defined in claim 7 wherein said bidirectional free wheeling circuit includes a parallel branch with a first bypass switch in series with a diode and poled from said workpiece to said electrode and a second bypass switch in series with a diode and poled from said electrode to said workpiece, said first and second bypass switches being connected in parallel, means  
5 for closing one of said bypass switches during one of said times and the other of said bypass switches during the other of said times.

15. A power supply as defined in claim 9 wherein said bidirectional free wheeling circuit includes a parallel branch with a first bypass switch in series with a diode and poled from said workpiece to said electrode and a second bypass switch in series with a diode and poled from said electrode to said workpiece, said first and second bypass switches being connected in parallel, means  
5 for closing one of said bypass switches during one of said times and the other of said bypass switches during the other of said times.

16. A power supply as defined in claim 11 wherein said bidirectional free wheeling circuit includes a parallel branch with a first bypass switch in series with a diode and poled from said workpiece to said electrode and a second bypass switch in series with a diode and poled from said electrode to said workpiece, said first and second bypass switches being connected in parallel, means  
5 for closing one of said bypass switches during one of said times and the other of said bypass switches during the other of said times.

17. A power supply as defined in claim 13 wherein said transformer is rated at least about 30 kW.

18. A power supply as defined in claim 6 wherein said transformer is rated at least about 30 kW.

19. A power supply as defined in claim 5 wherein said transformer is rated at least about

30 kW.

20. A power supply as defined in claim 4 wherein said transformer is rated at least about 30 kW.

21. A power supply as defined in claim 3 wherein said transformer is rated at least about 30 kW.

22. A power supply as defined in claim 2 wherein said transformer is rated at least about 30 kW.

23. A power supply as defined in claim 1 wherein said transformer is rated at least about 30 kW.

24. A power supply as defined in claim 23 wherein said pulse width modulator adjusts the pulses to create an arc current of at least 1000 amperes.

25. A power supply as defined in claim 13 wherein said pulse width modulator adjusts the pulses to create an arc current of at least 1000 amperes.

26. A power supply as defined in claim 6 wherein said pulse width modulator adjusts the

pulses to create an arc current of at least 1000 amperes.

27. A power supply as defined in claim 5 wherein said pulse width modulator adjusts the pulses to create an arc current of at least 1000 amperes.

28. A power supply as defined in claim 4 wherein said pulse width modulator adjusts the pulses to create an arc current of at least 1000 amperes.

29. A power supply as defined in claim 3 wherein said pulse width modulator adjusts the pulses to create an arc current of at least 1000 amperes.

30. A power supply as defined in claim 2 wherein said pulse width modulator adjusts the pulses to create an arc current of at least 1000 amperes.

31. A power supply as defined in claim 1 wherein said pulse width modulator adjusts the pulses to create an arc current of at least 1000 amperes.

32. A power supply as defined in claim 30 wherein said controller includes means for adjusting at least said first time.

33. A power supply as defined in claim 13 wherein said controller includes means for

adjusting at least said first time.

34. A power supply as defined in claim 6 wherein said controller includes means for adjusting at least said first time.

35. A power supply as defined in claim 5 wherein said controller includes means for adjusting at least said first time.

36. A power supply as defined in claim 1 wherein said controller includes means for adjusting at least said first time.

37. A power supply as defined in claim 36 wherein said input to said pulse width modulator includes a first input for controlling current amplitude by duty cycle of said pulses during the first time and a second input for controlling current amplitude by duty cycle of said pulse during said second time whereby said amplitudes are different.

38. A power supply as defined in claim 13 wherein said input to said pulse width modulator includes a first input for controlling current amplitude by duty cycle of said pulses during the first time and a second input for controlling current amplitude by duty cycle of said pulse during said second time whereby said amplitudes are different.

39. A power supply as defined in claim 6 wherein said input to said pulse width modulator includes a first input for controlling current amplitude by duty cycle of said pulses during the first time and a second input for controlling current amplitude by duty cycle of said pulse during said second time whereby said amplitudes are different.

40. A power supply as defined in claim 5 wherein said input to said pulse width modulator includes a first input for controlling current amplitude by duty cycle of said pulses during the first time and a second input for controlling current amplitude by duty cycle of said pulse during said second time whereby said amplitudes are different.

41. A power supply as defined in claim 1 wherein said input to said pulse width modulator includes a first input for controlling current amplitude by duty cycle of said pulses during the first time and a second input for controlling current amplitude by duty cycle of said pulse during said second time whereby said amplitudes are different.

42. A power supply as defined in claim 41 wherein said output voltage is less than about 100 volts.

43. A power supply as defined in claim 31 wherein said output voltage is less than about 100 volts.

44. A power supply as defined in claim 23 wherein said output voltage is less than about 100 volts.

45. A power supply as defined in claim 11 wherein said output voltage is less than about 100 volts.

46. A power supply as defined in claim 45 wherein said bidirectional free wheeling circuit includes a series branch with a first bypass switch in parallel with a diode and poled from said workpiece to said electrode and a second bypass switch in parallel with said diode and poled from said electrode to said workpiece, said first and second bypass switches being connected in series, means for closing one of said bypass switches during one of said times and the other of said bypass switches during the other of said times.

47. A power supply as defined in claim 2 wherein said output voltage is less than about 100 volts.

48. A power supply as defined in claim 1 wherein said output voltage is less than about 100 volts.

49. A power supply as defined in claim 48 wherein said common terminal is a system ground.

50. A power supply as defined in claim 42 wherein said common terminal is a system ground.

51. A power supply as defined in claim 31 wherein said common terminal is a system ground.

52. A power supply as defined in claim 23 wherein said common terminal is a system ground.

53. A power supply as defined in claim 1 wherein said common terminal is a system ground.

54. A power supply as defined in claim 53 wherein said bidirectional free wheeling circuit includes a series branch with a first bypass switch in parallel with a diode and poled from said workpiece to said electrode and a second bypass switch in parallel with said diode and poled from said electrode to said workpiece, said first and second bypass switches being connected in series, means for closing one of said bypass switches during one of said times and the other of said bypass switches during the other of said times.

55. A power supply as defined in claim 2 wherein said common terminal is a system

ground.

56. A power supply as defined in claim 1 wherein said common terminal is a system ground.

57. A power supply as defined in claim 1 including a controller for reducing the width of said pulses at the ends of said first and second times to reduce the arc current before changing between said positive and negative portions.

58. A power supply connectable to a source of AC line voltage for AC electric arc welding by an AC arc current across a gap between an electrode and a workpiece, said power supply comprising a high capacity transformer to convert said line voltage to an AC output voltage, a rectifier for converting said AC output voltage to a DC voltage of less than about 100 volts between a positive terminal and a common terminal at generally zero volts and a negative terminal and said common terminal, a first switch for connecting said positive terminal to said common terminal across said gap when a gate signal is applied to said first switch, a second switch for connecting said negative terminal to said common terminal across said gap when a gate signal is applied to said second switch, a pulse width modulator operated for generating a gate signal of pulses at a frequency of at least about 18 kHz, a first logic gate for directing said gate signal to said first switch for a first time, a second logic gate for directing said gate signal to said second switch for a second time and a controller to alternately operate said logic gates to create AC arc current.

59. A power supply as defined in claim 58 including a bidirectional, but selectable free wheeling circuit in parallel with said gap.

60. A power supply as defined in claim 59 wherein said bidirectional free wheeling circuit includes a series branch with a first bypass switch in parallel with a diode and poled from said workpiece to said electrode and a second bypass switch in parallel with said diode and poled from said electrode to said workpiece, said first and second bypass switches being connected in series, means for closing one of said bypass switches during one of said times and the other of said bypass switches during the other of said times.

61. A power supply as defined in claim 59 wherein said bidirectional free wheeling circuit includes a parallel branch with a first bypass switch in series with a diode and poled from said workpiece to said electrode and a second bypass switch in series with a diode and poled from said electrode to said workpiece, said first and second bypass switches being connected in parallel, means for closing one of said bypass switches during one of said times and the other of said bypass switches during the other of said times.

62. A power supply as defined in claim 58 wherein said transformer is rated at least about 30 kW.

63. A power supply as defined in claim 58 wherein said pulse width modulator adjusts the pulses to create an arc current of at least 1000 amperes.

64. A power supply as defined in claim 58 wherein said controller includes means for adjusting at least said first time.

65. A power supply as defined in claim 58 wherein said input to said pulse width modulator includes a first input for controlling current amplitude by duty cycle of said pulses during the first time and a second input for controlling current amplitude by duty cycle of said pulse during said second time whereby said amplitudes are different.

66. A power supply as defined in claim 58 wherein said common terminal is a system ground.

5 67. A power supply connectable to a source of AC line voltage for AC electric arc welding by an AC arc current across a gap between an electrode and a workpiece, said power supply comprising a high capacity transformer to convert said line voltage to an AC output voltage, a rectifier for converting said AC output voltage to a DC voltage between a positive terminal and a common terminal at generally zero volts and a negative terminal and said common terminal, a first switch for connecting said positive terminal to said common terminal across said gap when a gate signal is applied to said first switch, a second switch for connecting said negative terminal to said

10 common terminal across said gap when a gate signal is applied to said second switch, a pulse width modulator operated for generating pulses at a frequency of at least about 18 kHz, a first circuit for directing said pulses to said first switch for a first time, a second circuit for directing said pulses to said second switch for a second time and a controller to alternately operate said first and second circuits to create AC arc current and to reduce the width of said pulses at the end of each of said first and second times.